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Mixed Monolayers of Fluorinated and Hydrogenated Surfactants at the Water-Hexane Interface

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A combination of thermodynamic and x-ray scattering measurements of mixed monolayers of $CH_3(CH_2)_{19}OH$ and $CF_3(CF_2)_7(CH_2)_2OH$ at the water-hexane interface is ongoing. Samples are prepared by placing solutions of the surfactants in hexane in contact with pure water. For the sample composition studied by x-ray reflectivity, the interfacial tension measurements indicate the occurrence of two phase transitions as a function of temperature. A preliminary analysis indicates that at low temperatures the interface is nearly fully covered by a monolayer of $CH_3(CH_2)_{19}OH$, at intermediate temperatures the interface is fully covered by a monolayer of $CF_3(CF_2)_7(CH_2)_2OH$, and at high temperatures the interface contains domains of $CF_3(CF_2)_7(CH_2)_2OH$ coexisting with a gas monolayer phase. The structure of these phases are identical to those seen at the water-hexane interface in the presence of a single surfactant component [Ref 1,2], except in the crossover region between the low and intermediate temperature phases. Preliminary analysis of the x-ray data indicates that this crossover region contains coexisting monolayer domains of $CH_3(CH_2)_{19}OH$ and $CF_3(CF_2)_7(CH_2)_2OH$ that are larger than the x-ray coherence length. However, in the high temperature phase, a combination of the x-ray and thermodynamic data indicates that the domains of $CF_3(CF_2)_7(CH_2)_2OH$ must be smaller than the x-ray coherence length.

References:

1. A. M. Tikhonov, M. Li, M. L. Schlossman, J. Phys. Chem. B, 105, 8065 (2001).
2. A. M. Tikhonov, M. Li, M. L. Schlossman, in preparation.